ADOPTION NOTICE

National Electrical Manufacturers Association (NEMA) Standard NEMA WC 52, "*High Temperature and Electronic Insulated Wire-Impulse Dielectric Testing*", was adopted on 11 August 2000 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Defense Logistics Agency, Defense Supply Center, Columbus, ATTN: DSCC-VAI, P.O. Box 3990, Columbus, OH 43216-5000. DoD activities may obtain copies of this standard from the Document Automation and Production Service, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094. The private sector and other Government agencies may purchase the document from the National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209.

CONCLUDING MATERIAL

Custodians:
Navy - SH
Air Force - 11
DLA - CC

Review activity:
Navy - AS

Adopting Activity:
DLA - CC

(Project 6145-2258)

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

NEMA STANDARDS PUBLICATION/NO. WC 52

High-Temperature and Electronic Insulated Wire —Impulse Dielectric Testing

NEMA

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION ■ 2101 L STREET, N.W., WASHINGTON, D.C. 20037

Copyright by the National Electrical Manufacturers Association
Tue Mar 28 10:50:52 2000

TABLE OF CONTENTS

Copyright by the National Electrical Manufacturers Association
Tue Mar 28 10:52:10 2000

WC 52

HIGH TEMPERATURE AND ELECTRONIC INSULATED WIRE—IMPULSE DIELECTRIC TESTING

Published by

National Electrical Manufacturers Association
2101 L Street, NW
Washington, DC 20037
(202) 457-8400

© 1986 by National Electrical Manufacturers Association

Copyright by the National Electrical Manufacturers Association
Tue Mar 28 10:52:13 2000

Foreword

This Standards Publication was developed as an advancement over sparktesting at an industrial frequency followed by wet dielectric testing. Impulse dielectric testing embodies the benefits of testing under impulse conditions, the positive presence of corona on the surface of the wire for uniform stress distribution, and the sensitivity of modern electronic circuitry at relatively low power levels.

Initially an annular ring electrode was utilized by industry; later on it was found that a high density bead chain will provide more consistent results by reducing the effects of different ionizing conditions due to varying humidity or temperature in the testing environment.

A large number of NEMA companies was involved in the development of this Standards Publication. Very good correlation of test results was achieved over a period of 2½ years. This Standard now is referenced in many military and commercial specifications. It is recognized as a significant tool to reduce the possibility of creating conductor corrosion due to the presence of water beneath the insulation.

Publication No. WC 52-1985 revises and supersedes the NEMA Standards Publication No. HP 1-1979, *High Temperature Insulated Wire—Impulse Dielectric Testing*. User needs have been considered throughout the development of these standards.

These standards are periodically reviewed by the High Temperature Insulated Wire and Cable Section and the Electronic Wire and Cable Section of NEMA for any revisions necessary to keep them up to date with advancing technology. Proposed or recommended revisions should be submitted to:

Manager, Engineer Department
National Electrical Manufacturers Association
2101 L Street, NW
Washington, DC 20037

Copyright by the National Electrical Manufacturers Association
Tue Mar 28 10:52:16 2000

Scope

This procedure is intended for the dielectric testing of insulation of unshielded single-conductor wires. This procedure is not intended for use with multi-conductor cable.

Copyright by the National Electrical Manufacturers Association
Tue Mar 28 10:52:19 2000

HIGH-TEMPERATURE AND ELECTRONIC INSULATED WIRE—IMPULSE DIELECTRIC TESTING

Section 1

TEST EQUIPMENT

1.1 ELECTRODE

The electrode shall be of a bead chain construction that will give intimate metallic contact with practically all of the wire insulation surface. The electrode length shall be chosen so that, at the speed being used, the wire will be subjected to no less than 3 nor more than 100 pulses at any given cross section.

NEMA Standard 11-14-1985.

1.1.1 Wave Form

The wave form of the voltage applied to the electrode shall consist of a negative pulse followed by a damped oscillation. The negative pulse shall have a maximum 0 to 90 percent rise time of 75 microseconds. The repetition rate shall be between 200 and 250 pulses per second. The specified voltage shall be defined as the peak magnitude of the initial negative pulse. The peak value of the first positive overshoot and each of the following damped oscillations shall be smaller than the initial negative pulse. The wave form shall be analyzed to determine how long each pulse and the following damped oscillations (both positive and negative) remain at an absolute potential of 80 percent or greater of the initial negative peak. This time duration shall be between 20 and 100 microseconds. The dampening shall be such that the oscillations will be reduced to less than 1 percent of the peak voltage before the next pulse starts. The wave form measurement shall be made without the use of a coupling capacitor.

The peak and root means square (rms) voltages shall be measured with a wire of typical design located in the electrode and its conductor grounded.

NEMA Standard 11-14-1985.

1.2 VOLTMETER

A voltmeter measuring the peak voltage of the initial negative pulse at the electrode shall continually indicate the electrode potential. The full-scale meter reading shall be not greater than 15 peak kV. The meter accuracy shall be such that, when the voltage is adjusted to any specified value as measured by the instrument voltmeter, the actual electrode value will be within ±4 percent of the indicated voltage.

NEMA Standard 11-14-1985.

1.2.1 Capacitive Regulation

The indicated voltage shall decrease no more than 12 percent when a capacitive load connected between the electrode and ground is increased from an initial value of 12.5 to 25 picofarads per inch of electrode length.

NEMA Standard 11-14-1985.

1.3 FAILURE DETECTION CIRCUIT

There shall be a fault-indicating circuit which will give a visible or audible indication of a dielectric failure so that the wire can be stopped or suitably identified. The system shall be sufficiently sensitive so that a fault can be detected at 75 percent of the selected test voltage when the electrode is arced to ground through a 20,000-ohm resistance. The unit shall also be capable of detecting a fault which lasts for the duration of only one impulse.

NEMA Standard 11-14-1985.

Copyright by the National Electrical Manufacturers Association
Tue Mar 28 10:52:21 2000

Section 2

TEST PROCEDURE

2.1 SET-UP

The insulated wire shall be threaded through the electrode head and the conductor grounded at one or both ends. With the electrode head energized to the specified voltage (see the Appendix for typical test voltages), the wire shall pass from the payoff spool through the electrode and on to the take-up spool. The voltage shall be adjusted with the wire in the electrode.

NEMA Standard 11-14-1985.

2.1.1 Fault Identification

If any dielectric failures occur, they shall be cut out or suitably identified for subsequent removal, along with at least 2 inches of wire on each side of the fault. The equipment shall be so wired as to automatically deenergize the high voltage when the wire is stopped. During the string-up of a new length, every attempt shall be made to expose the entire length, including ends, to the specified voltage. Any ends not tested shall be clearly marked and removed subsequent to this test.

NEMA Standard 11-14-1985.

2.2 CALIBRATION

The instrument voltmeter and wave form shall be checked for compliance with these standards at each intended operating voltage by means of a calibrated oscilloscope connected to the bead electrode in conjunction with a suitable compensated attenuator. The peak magnitude of the initial negative pulse, the 0 to 90 percent rise time (first transition duration), the pulse duration at and above the 80 percent peak, the pulse repetition rate, and the capacitive regulation shall all be derived from the wave form display. All devices used for calibration shall have traceability to the National Bureau of Standards.

NEMA Standard 11-14-1985.

2.3 OPERATION OF TEST VOLTAGE GENERATOR (QUICK CHECK METHOD)

As a quick means to check the normal operation of the test voltage generator, the peak and rms voltages may be measured (using an electrostatic voltmeter with and without peak detecting attachment). The ratio of these voltages should be within 4.5 and 5.5 to 1. If not, careful calibration of the instrument voltmeter with particular attention to the wave shape of the voltage is recommended.

Authorized Engineering Information 11-14-1985.

Copyright by the National Electrical Manufacturers Association
Tue Mar 28 10:52:25 2000

Appendix

TEST VOLTAGES

Military Specification Designation		Bead Chain Voltage Settings kV Peak
MIL-W-16878	/1A	8.0
	/2A	10.0
	/3A	12.0
	/4	6.5
	/5	8.0
	/6	4.0
	/7	6.5
	/8	8.0
	/10B	8.0
	/11	6.5
	/12	8.0
	/13	4.0
	/14	8.0
	/15	10.0
	/16	12.0
	/17	8.0
	/18	10.0
	/19	12.0
	/20	4.0
	/21	6.5
	/22	8.0
	/23	4.0
	/24	4.0
	/25	6.5
	/26	6.5
	/27	8.0
	/28	8.0
	/29	6.5
	/30	10.0
	/31	10.0
	/32	8.0
	/33	8.0
	/34	8.0
	/35	8.0
MIL-W-22759	/1	6.5
	/2	6.5
	/3	8.0
	/4	8.0
	/5	8.0
	/6	8.0
	/7	8.0
	/8	8.0
	/9	9.5
	/10	9.5
	/11	8.0 (6.5 for #16AWG & larger gauges of wire)*
	/12	8.0 (6.5 for #16AWG & larger gauges of wire)*
MIL-W-22759 (continued)	/13	8.0
	/14	8.0
	/15	8.0
	/16	8.0
	/17	8.0
	/18	8.0
	/19	8.0
	/20	9.5
	/21	9.5
	/22	8.0
	/23	8.0
	/28	8.0
	/29	8.0
	/30	8.0
	/31	8.0
	/32	8.0
	/33	8.0
	/34	8.0
	/35	8.0
	/41	8.0
	/42	8.0
	/43	8.0
MIL-W-81044	/6	8.0
	/7	8.0
	/9	8.0
	/10	8.0
	/12	8.0
	/13	8.0
MIL-W-81381	/7	8.0
	/8	8.0
	/9	8.0
	/10	8.0
	/11	8.0
	/12	8.0
	/13	8.0
	/14	8.0
	/17	8.0
	/18	8.0
	/19	8.0
	/21	8.0
	/22	8.0
MIL-W-5086	/1A	8.0
	/2B	8.0
	/3A	8.0
	/4A	13.0
	/5B	8.0
	/6B	8.0
	/7A	8.0
	/8A	8.0

*This conforms with the military specification designation.

Authorized Engineering Information 11-14-1985.

Copyright by the National Electrical Manufacturers Association
Tue Mar 28 10:52:29 2000